

March 2, 2007

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Mail Stop: OWFN, P1-35
Washington, D. C. 20555-0001

10 CFR 50.73

Dear Sir:

**TENNESSEE VALLEY AUTHORITY - BROWNS FERRY NUCLEAR PLANT (BFN)
- UNIT 2 - DOCKET 50-260 - FACILITY OPERATING LICENSE DPR - 52 -
LICENSEE EVENT REPORT (LER) 50-260/2007-001-00**

The enclosed report provides details of an automatic turbine trip and reactor scram due to equipment failure during performance of the Main Generator Rheostat Test.

TVA is reporting this in accordance with 10 CFR 50.73(a)(2)(iv)(A), as an event that resulted in a manual or automatic actuation of the systems listed in paragraph 10 CFR 50.73(a)(2)(iv)(B) (i.e., Reactor Protection System including reactor scram or trip, and general containment isolation signals affecting containment isolation valves in more than one system). There are no commitments contained in this letter.

Sincerely,

Original signed by:

Brian O'Grady

cc: See page 2

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March 02, 2007

Enclosure

cc (Enclosure):

Ms. Eva Brown, Project Manager
U.S. Nuclear Regulatory Commission
(MS 08G9)
One White Flint, North
11555 Rockville Pike
Rockville, Maryland 20852-2739

Ms Margaret H. Chernoff, Project Manager
U.S. Nuclear Regulatory Commission
(MS 08G9)
One White Flint, North
11555 Rockville Pike
Rockville, Maryland 20852-2739

Mr. Malcolm T. Widmann, Branch Chief
U.S. Nuclear Regulatory Commission
Region II
Sam Nunn Atlanta Federal Center
61 Forsyth Street, SW, Suite 23T85
Atlanta, Georgia 30303-8931

NRC Resident Inspector
Browns Ferry Nuclear Plant
10833 Shaw Road
Athens, Alabama 35611-6970

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WDC:DTL:SWA:BAB

Enclosure

cc (Enclosure):

M. Bajestani, NAB 1A-BFN
A. S. Bhatnagar, LP 6A-C
R. H. Bryan, BR 4X-C
R. G. Jones, POB 2C-BFN
G. V. Little, NAB 1D-BFN
R. A. DeLong, SAB 1E-BFN
K. W. Singer, LP 6A-C
P. D. Swafford, LP 6A-C
E. J. Vigluicci, WT 6A-K
NSRB Support, LP 5M-C
INPO:LEREvents@inpo.org
EDMS WT CA – K

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LICENSEE EVENT REPORT (LER)

(See reverse for required number of
digits/characters for each block)

Estimated burden per response to comply with this mandatory collection request:: 50 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the Records and FOIA/Privacy Service Branch (T-5 F52), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to infocollects@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEQB-10202, (3150-0104), Office of Management and Budget, Washington, DC 20503. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

1. FACILITY NAME
Browns Ferry Unit 22. DOCKET NUMBER
050002603. PAGE
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4. TITLE: Automatic Turbine Trip and Reactor Scram Due To Equipment Failure During Performance of the Main Generator Rheostat Test.

5. EVENT DATE			6. LER NUMBER			7. REPORT DATE			8. OTHER FACILITIES INVOLVED	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REV NO.	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
01	11	2007	2007-001-00			03	02	2007	none	N/A
9. OPERATING MODE 1			11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check all that apply)							
10. POWER LEVEL 100			20.2201(b)		20.2203(a)(3)(i)		50.73(a)(2)(i)(C)		50.73(a)(2)(vii)	
			20.2201(d)		20.2203(a)(3)(ii)		50.73(a)(2)(ii)(A)		50.73(a)(2)(viii)(A)	
			20.2203(a)(1)		20.2203(a)(4)		50.73(a)(2)(ii)(B)		50.73(a)(2)(viii)(B)	
			20.2203(a)(2)(i)		50.36(c)(1)(i)(A)		50.73(a)(2)(iii)		50.73(a)(2)(ix)(A)	
			20.2203(a)(2)(ii)		50.36(c)(1)(ii)(A)		X 50.73(a)(2)(iv)(A)		50.73(a)(2)(x)	
			20.2203(a)(2)(iii)		50.36(c)(2)		50.73(a)(2)(v)(A)		73.71(a)(4)	
			20.2203(a)(2)(iv)		50.46(a)(3)(ii)		50.73(a)(2)(v)(B)		73.71(a)(5)	
			20.2203(a)(2)(v)		50.73(a)(2)(i)(A)		50.73(a)(2)(v)(C)		OTHER	
			20.2203(a)(2)(vi)		50.73(a)(2)(i)(B)		50.73(a)(2)(v)(D)		specify in Abstract below or in NRC Form 366A	

12. LICENSEE CONTACT FOR THIS LER

NAME
Steve Austin, Licensing Engineer, Licensing and Industry AffairsTELEPHONE NUMBER (Include Area Code)
256-729-2070

13. COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT

CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX
X	IT	RLY	G080	Y					

14. SUPPLEMENTAL REPORT EXPECTED

☐ YES (if yes, complete 15. EXPECTED SUBMISSION DATE) ☒ NO15. EXPECTED
SUBMISSION
DATE

MONTH	DAY	YEAR

ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced type written lines)

On January 11, 2007, at 0818 hours Central Standard Time the Unit 2 reactor automatically scrambled on a turbine generator load reject signal during the performance of Operating Instruction 2-OI-47, Main Generator Voltage Control Rheostat Test. Just prior to the reactor scram, with the main generator voltage regulator in the automatic mode, the operations personnel were in the process of performing a rheostat cleaning operation on the generator field voltage manual adjust rheostat (70P) by cycling the rheostat to its upper limit and back to zero. Following this step, per the OI the voltage regulator was placed in the manual mode. After a short time delay, Unit 2 received a turbine trip and subsequent automatic reactor scram. The turbine trip and reactor scram resulted from the failure of a relay in the main generator voltage regulator. During the performance of 2-OI-47, a contact on the regulator mode transfer relay (43A relay) in the auto/manual portion of the main generator voltage regulator control circuit failed. TVA replaced the 43A relay in the main generator voltage regulator circuit.

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET (2)	LER NUMBER (6)			PAGE (3)
Browns Ferry Nuclear Plant Unit 2	05000260	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	2 of 5
		2007	-- 001	-- 00	

NARRATIVE (If more space is required, use additional copies of NRC Form 366A) (17)

I. PLANT CONDITION(S)

Prior to the event, Units 2 and 3 were in operating in Mode 1 at 100 percent thermal power (approximately 3458 megawatts thermal). Unit 1 was shutdown and defueled. Units 1 and 3 were unaffected by the event.

II. DESCRIPTION OF EVENT

A. Event:

On January 11, 2007, at 0818 hours Central Standard Time (CST) the Unit 2 reactor automatically scrammed on a turbine generator load reject signal during the performance of Unit 2 Operating Instruction 2-OI-47, Main Generator [EL] Voltage Control Rheostat Test. Just prior to the reactor scram, with the main generator voltage regulator in the automatic mode, the operations personnel were performing a rheostat cleaning operation on the generator field voltage manual adjust rheostat (70P) by cycling the rheostat to its upper limit and back to zero. Following this step, per the operating instruction the voltage regulator was placed in the manual mode. After a short time delay Unit 2 received a turbine trip and subsequent automatic reactor scram.

During the event, all automatic functions resulting from the scram occurred as expected. All control rods [AA] inserted. The primary containment isolation system (PCIS) [JE] isolations Group 2 (residual heat removal (RHR) system [BO] shutdown cooling), Group 3 (reactor water cleanup (RWCU)) [CE], System Group 6 (ventilation), and Group 8 (traversing incore probe (TIP)) [IG] were received along with the auto start of the control room emergency ventilation (CREV) [VI] system and the three standby gas treatment (SGT) [BH] system trains. As a result of the low reactor water level and high reactor pressure, Operations briefly entered Emergency Operating Instruction, (2-EOI-001) Reactor Pressure Vessel Control.

Following verification that the 2-AOI-100-1, Reactor Scram, actions were completed the reactor mode switch was placed in shutdown. The PCIS actuations were reset; SGT and CREV systems were secured by approximately 0846 hours CST.

Reactor water level and heat rejection was maintained by the feedwater [SJ] and condensate [SG] system. Reactor pressure was controlled by the main steam system bypass valves [JI].

This report is submitted in accordance with 10 CFR 50.73(a)(2)(iv)(A), as an event that resulted in a manual or automatic actuation of the systems listed in paragraph 10 CFR 50.73(a)(2)(iv)(B) (i.e., reactor protection system including reactor scram or trip, and general containment isolation signals affecting containment isolation valves in more than one system).

B. Inoperable Structures, Components, or Systems that Contributed to the Event:

None.

C. Dates and Approximate Times of Major Occurrences:

January 11, 2007 at 08:18:44 hours CST Unit 2 operators received alarm "Turbine Trip on Generator Reverse Power."

January 11, 2007 at 08:18:45 hours CST Unit 2 received an automatic reactor scram.

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NARRATIVE (If more space is required, use additional copies of NRC Form 366A) (17)

January 11, 2007 at 1216 hours CST TVA made a four hour non-emergency report per 10 CFR 50.72(b)(2)(iv)(B) and an eight hour non-emergency report per 10 CFR 50.72(b)(3)(iv)(A).

D. Other Systems or Secondary Functions Affected

None.

E. Method of Discovery

The turbine trip and reactor scram were immediately apparent to the control room staff through numerous alarms and indications.

F. Operator Actions

Operations personnel responded to the event according to applicable plant procedures. The scram was uncomplicated. All operator actions taken in response to the scram were appropriate. These actions included the verification that the reactor had shutdown, the expected system isolations and indications had occurred, and subsequent restoration of these systems to normal pre-scram alignment.

G. Safety System Responses

The RPS logic responded to the turbine trip per design to initiate the reactor scram. All control rods inserted. The PCIS isolations Group 2 (RHR system shutdown cooling), Group 3 (RWCU system), Group 6 (ventilation), and Group 8 (TIP) isolation were received as expected, due to the lowering of the reactor water level, along with the auto start of the CREV system and the three SGT system trains. Emergency core cooling system actuation was not required.

III. CAUSE OF THE EVENT**A. Immediate Cause**

During the performance of 2-OI-47, a contact on the regulator mode transfer relay (43A relay) failed during the switch from automatic to manual control.

B. Root Cause

The root cause of the event is the 43A relay in the main generator voltage regulator reached its end of life. When the voltage regulator was taken from automatic mode to manual mode, the 43A relay de-energized as required; however, one set of contacts failed to make. Transferring the voltage regulator to manual on a weekly basis resulted in excessive actuations of the 43A relay, which increased the cyclic fatigue on the spring arms for the relay contacts. Prior to this event, Section 6.10 of 2-OI-47 was performed on a weekly basis without issue. The original 70P rheostat was an open face rheostat and the equipment manufacturer recommended that it be cleaned weekly. The rheostat has been replaced with a closed faced rheostat and the requirement to clean the rheostat on a weekly basis is no longer required.

C. Contributing Factors

An active preventative maintenance (PM) activity did not exist to replace the relay at regular intervals; as such, the relay was subject to further fatigue and end of life aging.

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Browns Ferry Nuclear Plant Unit 2	05000260	2007	-- 001	-- 00	4 of 5

NARRATIVE (If more space is required, use additional copies of NRC Form 366A) (17)**IV. ANALYSIS OF THE EVENT**

The Unit 2 main turbine tripped on main generator backup relay [EL] operation resulting in a Unit 2 high side breaker trip and subsequent reactor scram on turbine control valve fast closure. TVA's investigation into the event has determined that the main generator backup relays (211GB1 and 221GB2) actuated the lockout relay (286TF) which resulted in a generator/turbine trip. The generator backup relays detect under excitation and provide protection for loss of excitation events. During the event, the main generator voltage regulator test was in progress, cycling potentiometers for automatic and manual voltage regulator operation. When the attempt was made to transfer the controls from automatic to manual control, the turbine trip and reactor scram occurred. Recorded main generator voltage output data indicates that a large increase in negative reactive power (VARS) transpired during this event which would occur during a loss of excitation event. The main transformer phase voltage decreased and the main transformer current increased as would be expected to occur during a loss of generator field excitation event. The main generator backup relays actuated as required in response to the voltage and current changes to initiate a generator/turbine trip signal.

V. ASSESSMENT OF SAFETY CONSEQUENCES

The safety consequences of this event were not significant. All safety systems operated as required. PCIS groups 2, 3, 4, 6, and 8 isolations were as expected. Operator actions were appropriate and consistent with plant procedures. Reactor water level lowered to level 3, but remained above level 2; therefore, high pressure coolant injection [BJ] and reactor core isolation injection [BN] systems did not actuate. Eight main steam relief valves [SB] opened for a brief period. Once reactor pressure decreased to less than the lowest relief valve setpoint, the main steam turbine bypass valves maintained reactor pressure. Reactor water level was recovered and maintained by the reactor feed pumps.

Reactor scram from a turbine trip from 100% power is a transient for which BFN is analyzed. The Updated BFN Final Safety Analysis Report (UFSAR) Section 14.5.2.4 and 14.5.2.5 specifically address the main turbine trip event. The analysis assumes that the most limiting initial conditions of: end of cycle fuel exposure, a core power at 100% rated, a core flow of 105% of rated, and normal feed water temperature. UFSAR Section 14.5.2.4 assumes the turbine bypass valves [SB] to open and control reactor pressure following brief MSRVS actuations. UFSAR Section 14.5.2.5 assumes the turbine bypass valves fail to open and control reactor pressure and is a more severe event than reactor scram with bypass valve operation. In the event described by this LER the bypass valves operated as described in UFSAR Section 14.5.2.4, and the event was fully bounded by the analysis. Therefore, TVA concludes that the health and safety of the public was not affected by this event.

VI. CORRECTIVE ACTIONS**A. Immediate Corrective Actions**

Operations personnel placed the reactor in a stable condition in accordance with plant procedures.

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B. Corrective Actions to Prevent Recurrence⁽¹⁾

1. TVA replaced the 43A relay in main generator voltage regulator circuit.
2. TVA will review the weekly requirement to perform Section 6.10 of 2-OI-47 and establish a more appropriate testing interval.
3. TVA will initiate PM activities to replace the 43A relays on Units 1, 2, and 3.

VII. ADDITIONAL INFORMATION

A. Failed Components

General Electric 43A relay part number 3S2791G138B5.

B. Previous LERs on Similar Events

None.

C. Additional Information

Corrective action document PER 117916.

D. Safety System Functional Failure Consideration:

No safety functions were compromised as a result of this event. Therefore, this event is not considered a safety system functional failure in accordance with NEI 99-02 in that functional capability of the overall system was not justified.

E. Loss of Normal Heat Removal Consideration:

The condenser remained available, providing a normal heat removal path following the reactor scram. Accordingly, this event did not result in a scram with a loss of normal heat removal as defined in NEI 99-02.

VIII. COMMITMENTS

None.

(1) TVA does not consider these corrective actions as regulatory requirements. The completion of these actions will be tracked in TVA's Corrective Action Program.